

CALIFORNIA DEPARTMENT OF
TRANSPORTATION



CALIFORNIA TRANSPORTATION JOURNAL 2011 | ISSUE 1

DIRECTORS LETTER

CLIMATE CHANGE

SMOOTHER ROADS

TSUNAMI SAFETY

BRIGHTER IDEA

Edmund G. Brown Jr.

Governor

State of California

VACANT

Secretary
Business, Transportation
& Housing Agency

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Message from the Caltrans Director

Dear Reader:

This issue of the California Transportation Journal is organized around the topic of climate change, the environment and the ways in which the California Department of Transportation (Caltrans) works as a responsible steward to the planet while ensuring that our highway system is as efficient and effective as possible.

To that end, our first story [Turning a More Vivid Shade of Green](#) cites the state's Global Warming Solutions Act of 2006, which is the foundation for Caltrans' pioneering attempts to reduce harmful greenhouse emissions generated by California's widespread transportation system. Some have estimated that the transportation sector produces the largest single proportion of greenhouse gases in the state. Yet, California hopes to reduce those emissions to 1990 levels by 2020. And Caltrans plays a major part in those efforts.

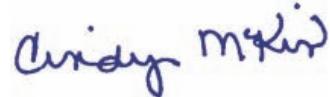
Our second story [Smoothen Roads](#) focuses on the management of the state's highways, and how Caltrans is making them smoother and longer-lasting than ever before. This story, which focuses on finding and repairing faults and flaws on California's aging roadways, also can be seen in the light of lowering the state's "carbon footprint." Caltrans is using innovative computer programs to analyze the state's 50,000 lane-miles of pavement. And, we are working with pavement manufacturers to find new ways to produce longer-lasting pavement, while reducing concrete's "carbon cost" to our atmosphere.

Meanwhile, Caltrans is playing a major role in protecting California's coastline from future tsunamis in [The Great Harbor Wave](#). Tsunamis, a Japanese word meaning "harbor wave," can flatten coastal communities in seconds, and steal an untold number of lives. However, Caltrans is working with other agencies to improve local tsunami warning systems, beginning with the state's north coast and working southward toward major population centers.



And finally, bridges owned and operated by Caltrans are being refitted with “light-emitting diode” fixtures that can last up to five times longer than older high-pressure sodium bulbs that once illuminated many state structures. The LEDs not only operate for longer periods, but they cost less, and can reduce the amount of time maintenance crews are exposed to potentially lethal traffic. They are cheaper, longer-lasting and safer – and some critics say, the new lights put out a warm, white glow that is easier on the human eye. What's not to like about them?

In fact, I trust that all the stories in this issue will inform, entertain and illuminate. So, welcome to this issue of the California Transportation Journal.

A handwritten signature in blue ink that reads "Cindy McKinley". The signature is fluid and cursive, with "Cindy" on top and "McKinley" below it, though the two names are connected.

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**Turning a More Vivid Shade of Green: Caltrans
Takes a Stand on Climate Change, Global Warming**

By Julia Biggar – Caltrans Associate Transportation Planner

In 1971, barely two years before a global oil shortage shook the world's economy, a whimsical commercial for a well-known automobile oil filter, posed an eerily prescient question, disguised as a statement: "You can pay me now, or you can pay me later."

Today, more than 35 years later, the ambivalent statement/question remains. The world may be exhausting its supply of petroleum, but the larger question now has to do with abundance of fossil fuel-generated greenhouse gas emissions (GHG) that threaten the planet we call home. And for many Americans, the ambivalence is still unresolved. Do we address global warming and climate change today, or do we leave it to our children and grandchildren? Pay me now, or pay me later?

The California Department of Transportation (Caltrans) has chosen to follow the lead of the California Global Warming Solutions Act of 2006, considered to be the most dramatic climate change policy of any state in America. Known as Assembly Bill 32, the act created a comprehensive, multiyear program of regulations, incentives, and market mechanisms (such as a cap and trade system) to effect a serious reduction of GHG emissions in the Golden State.

For example, AB 32 calls for reductions in GHG emissions to 1990 levels by 2020 — some 15 percent less than today. This requires reducing annual emissions for every person in the state from 14 tons today to 10 tons by 2020. It further makes cuts equivalent to 1990 emission levels by 2050, a drop of 80 percent.

The issue is real for California, whose residents and economy rely on one of the most extensive transportation infrastructure systems in the world; thousands of miles of roads, highways and railroads, hundreds of airports, thousands of bridges and ports that help drive and support the eighth largest economy. Caltrans, in particular, is responsible for maintaining and managing vast portions of the state's transportation infrastructure. As such, Caltrans is embracing a unique opportunity to become a leader in climate change adaptation and mitigation.

The relationship between transportation and climate change resulting from GHG emissions is fairly well understood. However, our knowledge is still developing about how our transportation infrastructure is affected and our ability to adapt to the effects of global warming. Emissions of GHG and the related subject of global climate change are emerging as critical issues for the entire transportation community.

State departments of transportation throughout the nation are establishing best practices to deal with the situation. They understand the impacts of climate change may include flooded tunnels, coastal highways, runways and railways, buckled highways and railroad tracks, and submerged dock facilities. The long-term costs of inaction in the face of climate change will likely be much higher than the price of attempting to mitigate today's GHG emissions.

Without doubt, transportation plays a big role, generating approximately 38 percent of the total GHG emissions in California — the largest single source of emissions in the



Climate change could lead to more, or less, precipitation. Increased rain may cause serious erosion on coastal and mountain roadways.



The Caltrans headquarters in Los Angeles has photovoltaic cells on its south side, which generate about 5 percent of the building's energy.

state. Therefore, cuts in transportation emissions are critical and must be an integral part of the climate change solution. Fortunately, California is leading the national climate change battle. The state has a long-standing reputation as a leader in environmental protection, and Governor Schwarzenegger's landmark GHG reduction targets are much more rigorous than anything at the federal level.

To meet AB 32's goals, the California Air Resources Board drafted a plan to

identify the main strategies California will need to reduce GHG emissions. To reduce the majority of transportation's GHG emissions, the plan calls for an increase in the fuel efficiency of motor vehicles (known as Pavley standards) by 2016. It also calls for a decrease in carbon intensity (low-carbon fuel standard) of vehicle fuels by 2020. In other words, automobiles would need to get better gas mileage and emit less carbon within the next decade.

In 2008 Senate Bill 375 was signed. Its aim is to link land use planning, transportation investments, and GHG reductions. It will change the transportation and land use planning process in California, with the goal of producing more efficient communities. SB 375 attempts to accommodate the state's growing population with new housing closer to employment and shopping centers to reduce reliance on the automobile. It will require the 18 Metropolitan Planning Organizations (MPOs) in California to meet a GHG reduction target for cars and light duty trucks.

Advancing the Science of Climate Change

“Climate change is occurring, is caused largely by human activities, and poses significant risks for — and in many cases is already affecting — a broad range of human and natural systems.”

— the National Academy of Sciences

Each MPO must prepare a “sustainable communities strategy,” identifying how they will achieve the reduction target. These strategies will promote smart growth strategies such as development near public transit, a mix of residential and commercial uses, and affordable urban housing to help reduce suburban and ex-urban sprawl. SB 375 also allowed for a more streamlined California Environmental Quality Act (CEQA) process for certain residential developments.

With these two climate change bills in mind, Caltrans is working to reduce emissions from its operations and to ensure the transportation system is capable of withstanding climate change in the future. The Department is responsible for developing an efficient transportation system for all users and for reducing emissions from the buildings and equipment it owns and operates. The state's roadways consume energy in many ways, including lights, water pumps, traffic signals, controllers, and signage.

In addition, the Department relies on a fleet of more than 13,000 vehicles, ranging from mobile equipment, light-duty vehicles, construction and heavy-duty vehicles, to special-purpose vehicles that perform functions such as snow removal, roadway cleaning, painting, emergency response, and other roadway maintenance assignments. A number of energy conservation and GHG reduction measures have been implemented within the Department, and research continues to identify new ways to reduce our carbon footprint.

Caltrans is playing a significant role in supporting California's climate action legislation. The Climate Change Branch and the Energy Conservation Program within the Caltrans Division of Transportation Planning have been involved in creating a number of solutions to reduce emissions from the Department's operations and from the statewide transportation system. The Department's Climate Action Program promotes clean and energy efficient transportation and provides guidance for mainstreaming energy and climate change issues into business operations.

The Department's approach to reducing GHG's is threefold: vehicle and fuel technology; transportation system efficiency; and greening and resource conservation, a framework provided by the Director's Policy, “Energy Efficiency, Conservation, and Climate Change.”

In addition to creating a more efficient transportation system, the Caltrans Division of Equipment works to reduce its energy use and GHG emissions. Its “greening the fleet” program began in 2000 to lower emissions by ensuring that its vehicles and equipment were more energy efficient. The program also promotes alternative fuels and low-emission vehicles. Examples include using hybrid vehicles, the E85 blend of gasoline and ethanol, and propane-fueled vehicles. The Department has also installed diesel particulate filters on heavy duty equipment, and employs solar-powered equipment, low-dust street sweepers, and hydrogen demonstration vehicles.



Caltrans has “greened” its fleet since 2000, and promotes the use of alternative fuels such as an E85 blend of ethanol and gasoline.

The energy conservation program within the Caltrans Division of Transportation Planning has developed and implemented numerous energy reduction measures. The program benchmarks energy consumption at numerous facilities to identify ways to reduce the Department’s impact on the state power grid. This initiative also upgrades traffic signals from high watt incandescent lamps to low energy light-emitting diode fixtures, and assists in photovoltaic (solar) power generation projects.



New state buildings, including those at Caltrans, are designed to Leadership and Energy and Environmental Design (LEED) standards.

The program is also helping to implement the Governor’s executive order S-20-04, which calls for reducing electricity consumption in state buildings 20 percent by 2050. Also, all new facilities and major facility rehabilitation projects are being designed to Leadership and Energy and Environmental Design (LEED) Silver or better certification rating standards. (LEED is an international certification and verification program that strives to conserve resources through wiser “green” building design.)

Through engineering and materials science, Caltrans is also progressing toward more environmentally friendly paving products that are as long lasting as conventional methods. For example, producing a ton of cement produces about a ton of carbon dioxide. However, GHG emissions are drastically lowered by using new materials such as fly ash in concrete production. The conventional hot mix asphalt paving process is being replaced when possible with warm mix asphalt, which uses less energy to heat with reductions of 50 to 100° F. In short, it emits less heat when being placed on the road. When possible, the Department also recycles and reclaims paving materials. Studies are underway to determine the potential use of permeable and cool pavements.

Many other efforts are being undertaken to reduce the Caltrans carbon footprint while maintaining a safe, efficient transportation system. In fact, Caltrans believes that creating a sustainable transportation system will yield other benefits, including more efficient use of transportation resources, reduced dependency on fossil fuels, greater energy security, improved mobility and travel options, and more livable communities.

Caltrans is proud to be at the forefront of taking on the climate change challenge, and the Department sees this moment as an opportunity to transform the way we do business, moving toward clean and sustainable technologies to ensure that all Californians can enjoy clean air, unpolluted water, and a healthy environment.

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California Finding Cost-Effective New Ways to Make Roads Smoother and More Environmentally Friendly

By John Robin Witt, Editor – California Transportation Journal

California is taking a new look at the pavement on its aging highways. Employing a combination of radar, automated pavement scanning machines, and an advanced computer modeling program, the California Department of Transportation (Caltrans) is working to reshape the State Highway System (SHS) with smoother, longer-lasting paving surfaces — coupled with a lower “carbon footprint” than previous California roadways.

The challenge is substantial. At an estimated value of \$1.2 trillion, the 50,000 lane-mile SHS carries 35 million vehicles that log approximately 264 billion miles a year. In addition, California’s climate ranges from mountain snow and rain forests in the north to vast deserts of rocky soil and yucca trees in the south. The state is home to salty air and foggy coastlines and the high summer heat of the Central Valley. And, of course, highways must stand up to those highly varied conditions.

It’s little wonder that California’s urban freeways and rural roadways take such a merciless beating. Nonetheless, Caltrans engineers are unwilling to make excuses for poor roads. There must be a better way to construct and maintain those highway miles.

Scanning for Highway Faults

Caltrans has chosen to attack the highway system’s cracks, potholes and obsolete sections through PaveM, a pavement management system that combines automated



Caltrans highways are found in a variety of environments, from north coast rain forests to sandy deserts.

highway surveys and radar soundings with an advanced computer program that sorts multiple variables and recommends the best strategies to improve not only a specific roadway but the entire SHS. For example, PaveM might consider such factors in a project as the anticipated lifetime of a roadway, how easily it can be constructed, the type and life expectancy of materials used, smoothness of ride, costs of its entire life cycle, safety characteristics, and the sum of greenhouse gases (GHG) the project would generate.

The new system is likely to take several years to be put completely into place. But when it is fully implemented, “We will be able to balance all the variables not only of a single project, but for the entire network,” said Tom Pyle, Chief of the Caltrans Office of System Performance and Data Collection (System Performance). “The system will be available to every (Caltrans engineer) in the state, and the computer will give us options — although humans will make the ultimate decisions. And every year the system will get smarter. At that point, our pavement management system will pay for itself.”

A Caltrans History of Pavement Management

In 1979, California was among the first states to adopt a pavement management system, based upon information from biennial pavement condition surveys, which were then stored on a mainframe computer. Maintenance supervisors used the information to confirm their suspicions about pavement deterioration, and then to make recommended repairs. The process, based on a method developed by former Caltrans employee Francis N. Hveen, was derived from road test sections from the 1940s.

However, Hveen’s system to manage pavement failed to account for a number of variables, including local climates, and structural properties of certain materials and designs. By 2007, Caltrans had moved to a new means of analysis, known as the Mechanistic-Empirical (M-E) pavement design method. The M-E method helped to create more efficient and cost-effective pavement designs that could predict specific pavement failures, make better use of available materials, and account for the effect of California’s climatic zones.

A New Way of Understanding Pavement

Today, Caltrans engineers are pushing for even better ways of designing, building, and rehabilitating highways. “There are more choices in pavement than concrete or asphalt,” said Hector Vergara, an engineer with the Caltrans Office of System Development and Performance (System Development). Using PaveM, “We want to plan strategies for pavement that could potentially save California billions of dollars in highway design for both building and maintenance.”

To do this, OSD&P is executing the first phase of a three-part strategy. Part one is to collect “structural section” snapshots of the entire highway network by using ground penetrating radar (GPR), that is, to look into the layer cake profile beneath a highway’s pavement. These structural sections will be collected on every lane mile on the SHS. The GPR vehicle, containing both high-resolution and lower frequency antennae, can move at the speed of adjacent traffic while mapping for voids and moisture within or below the pavement, said Michael Hughes, a branch manager with Fugro West, Inc., Caltrans’ GPR contractor.

That might mean, for example, that GPR can peer into a roadbed through four inches of asphalt concrete paving, a foot of aggregate base, and another two feet of subbase. By looking at the radar profile, engineers can see the details beneath the pavement. This subsurface picture will allow Caltrans to understand repairs to the highway that have been forgotten over the years, unrecorded maintenance, or faulty engineering and construction. “All states have pavement management systems,” said Pyle, “but only California uses ground penetrating radar at the network level for pavement management. We’re moving from eyeballs to electronic scanning equipment — but double-checked by eyeballs.”



The Department maps every mile of highway, in this case Interstate 5 in Sacramento.

The second part of the strategy is the Automated Pavement Condition Survey (APCS), which automatically evaluates the surface condition. The APCS consists of radar equipment packed into a van to measure the profile of the pavement surface to within a few millimeters. It sees cracks, faults, and potholes on the pavement surface, and keeps a video log of surface conditions as well as any construction changes made over the years. The result is a detailed report of all types of pavement distresses, including data on pavement roughness known as the International Roughness Index, or IRI, which essentially quantifies the smoothness of ride on a given stretch of highway. In conjunction with pavement core samples to confirm the type and thickness of material used, the GPR and APCS can provide a detailed cross-section analysis of any highway.

In the third part of the strategy, the GPR and APCS information can be loaded into a computer program called PaveM. Based on that program, Caltrans can develop models that determine life-cycle cost analysis (LCCA) of different pavement preservations strategies. The strategies in turn, allow engineers to select the most cost-effective strategies to keep good pavement in acceptable condition, replace bad pavement, and predict the extended life of pavement.



California highways face many challenges, such as the corrosive effect of extreme winter weather mixed with the use of tire chains. For example, Interstate 80 carries traffic over the storied Donner Summit, a vital link for goods movement.

The computer program could be compared to a hypothetical time machine. Assume that Caltrans wants to design a new highway. Engineers would feed a number of variables into the computer, such as climate, highway traffic load, the number of truck axles that will pass over the pavement, and how long the highway needs to last. Then they press a button, and within minutes PaveM can predict how long the pavement will last and what kind of failures it might experience. How rough will it be? Will it crack in winter or melt in hot weather? Will it begin to show rutting patterns too early?

And perhaps the best part, PaveM will provide realistic data to feed another computer program called RealCost developed to calculate LCCA, which the Federal Highway Administration (FHWA) describes as “an engineering economic analysis tool” for a single project.

“The LCCA is used to evaluate long-term investment options,” said Mario N. Velado, P.E., Senior Transportation Engineer with the Division of Maintenance (DM). “It is an economic analysis that compares sound engineering solutions for a given project and is used to evaluate competing pavement alternatives to determine which one is the best investment option for a given project over an extended period of time.” The LCCA analyzes not only a transportation agency’s direct expenditures, but user costs resulting from work zone operations, according to the FHWA.

The Caltrans DM is also working with the University of California, Davis and UC Berkeley to develop an updated version of RealCost. Velado said that the new version will be able to compare more than two alternatives at a time, predict future costs, and select a rehabilitation schedule to follow after a pavement type is selected.

Global Warming Concerns

In addition to understanding the condition of California highways, Caltrans is also concerned about the threat of global climate change and the carbon footprint that constructing highways may leave.

In fact, the U.S. Environmental Protection Agency awarded Caltrans first place for Innovation in the Coal Combustion Products Partnership Awards. The award recognizes that California has always been a leader in protecting the environment, and we are leading the nation in our commitment to reduce greenhouse gas emissions.

Caltrans and the rest of state government have taken tangible steps to reach this goal, and the reformulated cement concrete will help make the San Francisco-Oakland Bay Bridge (SFOBB) stronger.

For example, Pyle formerly managed the Concrete Office at the Caltrans Transportation Lab for 10 years, recently worked on a special assignment with the California Air Resources Board, and led the statewide efforts to reduce carbon dioxide (CO₂) emissions from cement production and concrete use per AB 32 requirements.



New technology is allowing Caltrans to pave highways that perform at higher levels, as well as protecting the state's environment.

He pointed out that Caltrans often uses concrete for long-lasting highways throughout the state. Yet, the 11 concrete plants in California, alone, produce between 1.5 and 2 percent of all CO₂ emissions in the Golden State. For example, producing a ton of concrete also renders about a ton of CO₂. Or, think of it this way: just one delivery truck full of cement concrete represents 5,150 pounds of CO₂ generated into the air. Compare that to a passenger car that spews

approximately 11,450 pounds of CO₂ through its tailpipe in a year's time. In other words, just two trucks full of cement concrete, each making a delivery, equals about the same amount of the greenhouse gas CO₂ as one passenger car releases in a year.

The question then becomes: can Caltrans continue building high-strength, long-lasting concrete highways, given the "carbon cost" to our air? Well, yes, it is possible, said Pyle. One solution may be "fly ash," a product of coal-powered electric plants. The United States produces more fly ash than any other country in the world, except for the People's Republic of China.

The good news is that Caltrans has a mandate to replace about 25 percent of its cement concrete with fly ash. On such projects, fly ash released during its manufacture has already been "spent" — at the electrical plant — so Caltrans is adding only minimally to the problem of climate change. Instead, Caltrans and others that use fly ash are reducing the amount of coal-burning waste going into landfills, and reducing by 25 percent the amount of cement concrete needed on a given project.

The fly ash solution makes so much sense that Caltrans engineers have used it to construct the new SFOBB. And because concrete with a 50-50 mix of Portland cement and fly ash is highly resistant to salt and marine fog, in addition to generating less heat, Caltrans used it to build the under-the-bay water footings on the SFOBB, which is designed to carry some 350,000 vehicles a day and last 150 years.

In summary, Caltrans is on the cutting edge of concrete technology with newly released concrete specifications that call for maximum use of supplementary materials. For the first time, Caltrans allows ternary blends, a concrete mix with three different cement materials. This results in concrete mixes that set earlier and stronger, are more permeable, and shrink less than other mixes. These concrete mixes result from an engineering prospective but also lead to more environmentally friendly concrete.

Caltrans is committed to pursuing new techniques, materials, and ideas to overcome the challenges of increased traffic on its transportation system and is working hard to reinvent itself to design, build, and maintain the highway system of the 21st century.

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Readyng Californians for a Tsunami:

The Great 'Harbor Wave'

By Phil Frisbie – Caltrans Information Officer

*Three north coast counties lead the way in preparing California's coastline
for future tsunamis.*

The Pacific "Ring of Fire" etches a huge parabolic arc up from New Zealand and Asia through the Aleutian Islands of Alaska, and ultimately south along the coast of California and the Americas. It is home to more than 75 of the world's active and dormant volcanoes. Therefore, it is the land both of earthquakes and tsunamis, their seaborne offspring.

Tsunami, which means "harbor wave" in Japanese, can be caused by earthquakes, landslides, huge meteorites slamming into the ocean, or great tectonic plates that snap and lurch under the seabed. The resulting series of watery undulations, called a "wave train," races along the ocean surface, until it batters some island, archipelago or continent unfortunate enough to stand in the way.

California knows about these malicious waves based on grim experience. A reminder of their dangers arrived the morning of March 11 when a tsunami triggered by a 9.0-magnitude earthquake in Japan slammed into the California coastline. Governor Jerry Brown declared states of emergency in six northern and central California counties -- Del Norte, Humboldt, San Mateo and San Cruz counties on March 11, and in Mendocino and San Luis Obispo counties five days later.

Santa Cruz and its small craft harbor was among the most-affected communities in California. It suffered significant damage to piers and watercraft. Unfortunately, California has seen such waves before, and the next one could be much worse.



Caltrans helps to warn residents and visitors about tsunami dangers.

More than 80 tsunamis have pummeled the California coast in the last 150 years. For example, the 8.8-magnitude earthquake in Chile on February 27, 2010, resulted in the National Weather Service (NWS) issuing a tsunami advisory along the entire California coastline — a reminder that home-grown earthquakes are not the only ones we need to plan for. Only a few feet high, this tsunami turned out to be minor when it reached California.

The 1964 Alaska tsunami was generated by a 9.2-magnitude earthquake near Prince William Sound. The damage was greatest along the Alaska coastline, resulting in \$300 million to \$400 million in damage and 119 deaths. In California the great wall of water killed 12 people and caused an estimated \$17 million in damage (about \$118 million in today's dollars) as it bullied its way southward along the coast. Most of the damage was at Crescent City, which was inundated with a 21-foot wave, causing 10 deaths, flooding a large portion of the city, and causing \$15 million in damage. Two other deaths occurred in Bolinas, barely 10 miles north of San Francisco, and in Los Angeles.

All of these tsunamis originated at great distances from California, allowing for warning times measured in hours. But a local tsunami, generated by an offshore earthquake or submarine landslide, could allow residents just minutes of notice before slamming into the shoreline. In either case, a good warning system is critical in reducing deaths when the next large tsunami occurs. Information is vital for people in the tsunami hazard zone; anywhere less than 30 feet above sea level.

The nationwide Emergency Alert System (formerly the Emergency Broadcast System) is in place to notify the public in times of emergency. For example, tornado warning tests occur annually throughout much of the United States. The next big tsunami could hit at any time, yet until recently most coastal communities had never tested their tsunami warning communications systems.

The Japan tsunami activated the Emergency Alert System for real (ironically cancelling the next test, which had been scheduled for March 23). The participating federal, state, and local agencies will use information gathered from this recent event to improve next year's test, or the next tsunami warning.

Since 2008 Caltrans District 1, located in California's northwest corner, has participated in annual tsunami warning communications tests, in coordination with federal, state, and local partners, including the NWS, California Emergency Management Agency (Cal EMA, formerly the Governor's Office of Emergency Services), and the counties of Del Norte, Humboldt, and Mendocino. These tests, first conducted in Humboldt County and then expanded to include Del Norte County in 2009 and Mendocino County in 2010, are providing valuable information that will improve the local tsunami warning system.



Caltrans District 1, on the state's northwest corner, has participated since 2008 in tsunami warning tests. Lessons from the tests will be used to improve warning systems along California's more than 800-mile coastline. (#10)

The most recent exercise, on March 24, 2010, simulated a distant tsunami that would have provided local officials some time for preparation. It included a broadcast on the National Oceanic and Atmospheric Administration weather radio and a message on local radio and television stations. It also included activating four remote sirens, testing reverse 911 telephone calls, powering up Caltrans' changeable message signs and highway advisory radios, and flying an airplane along the coast from Crescent City to northern Humboldt County broadcasting audibly to those along the shore. The results of the test included one siren that failed to activate, a radio station that did not receive the message, and plane problems that limited the range of its message. However, a practice drill is the best time to discover and deal with such problems.

The lessons learned will also be applied statewide as the tests are expanded southward. Each year one or more counties will be added to the test until all of California's 15 coastal counties are participating. This area encompasses three major urban areas, 73 cities, and four major ports. In addition, the California coastline attracts up to two million visitors during the summer months.

Still, warning the public is not enough if residents are unaware they are within a tsunami hazard zone. A person could be far from the ocean and still be in danger, so Caltrans and local agencies are installing signs to alert the public when they are entering, within, or leaving a tsunami hazard zone. In some areas, evacuation signs have also been installed to direct people to safe ground.

Public education is being conducted through brochures and the news media, in addition to the tsunami hazard signs. Brochures are available from Cal EMA and NWS. News organizations are provided with information prior to each test to prepare the public, and then post-test information reinforces the success and rationale for the exercise. Finally, the tsunami hazard signs are a constant reminder to those who live, work, and travel through areas that could be inundated during a tsunami.

Tsunamis may always be capricious, but with a bit of warning, California hopes to protect human lives and property when these great walls of water wash upon our shores.

For more tsunami information, visit:
National Weather Service's Tsunami Center: <http://www.tsunami.gov/>
Emergency Management Agency: <http://www.caeme.ca.gov/>
<http://www.dot.ca.gov/hq/traffops/signtech/signdel/tsunami.htm>

Tsunami warning levels:

- **Warning:** A potential tsunami with significant widespread inundation is imminent or expected. Widespread, dangerous coastal flooding accompanied by powerful currents is possible and may continue for several hours after the arrival of the initial wave.
- **Advisory:** A potential tsunami which may produce strong currents or waves exists. Significant widespread inundation is not expected.
- **Watch:** A potentially dangerous distant seismic event has occurred which may later impact the watch area with a tsunami. Be ready to take action if a warning is issued.
- **Information Statements:** An earthquake has occurred or a tsunami warning, watch, or advisory has been issued for another section of the ocean. In most cases, information statements are issued to indicate there is no threat of a destructive tsunami in your area.

Tsunami safety rules:

- Keep calm and listen to emergency officials.
- If you can see the tsunami it is too late; tsunamis move faster than you can run.
- A tsunami is a series of waves that continue for many hours; not one single wave.
- Move to high ground: 100 feet above sea level or 1 mile inland, away from river valleys.
- If you cannot move to high ground, a concrete building's upper floor may be safe. Use the stairs.

Strong coastal earthquakes can trigger tsunamis. Know nature's warning signs:

- A strong earthquake lasts 30 seconds or longer and causes difficulty in standing.
- Noticeable rapid rise or fall of coastal water.
- A large ocean roar may precede a tsunami.
- Not every earthquake will cause a tsunami.
- Local tsunamis often happen more quickly than warnings can be issued.
- When in doubt, evacuate.
- A small tsunami at one beach can be a giant a few miles away. All tsunamis are potentially dangerous even though they may not damage every coastline they strike.
- Stay tuned to your radio, marine radio, NOAA Weather Radio, or television.
- Keep emergency supplies at the ready. Prepare for power failures and water shortages.
- Wait for emergency officials' "All clear."

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Caltrans Has a Brighter Idea: LED Lights on State Bridges

By Bob Haus – Caltrans Public Affairs Officer

Something about the bridge looks, well, a little different.

Motorists who haven't passed over the Richmond-San Rafael Bridge in a while may have a pleasant surprise due to the new summer ambience of soft light-emitting diode (LED) illumination on the structure. In place of the once garish orange-yellow pools of light, the LED fixtures now throw off softer, cleaner-looking and more energy-efficient light.

Of course, some drivers may pass by the overhead poles without a thought, vaguely registering that something has changed. But for the more perceptive connoisseurs of antismog and climate change technology, a closer look is warranted. The overhead poles with "cobra lights" have been replaced with softer-illuminating LEDs that resemble, as much as anything, upside-down pancake griddles.

"You can see the difference between the lights," said Bob Haus, a Caltrans Public Affairs Officer headquartered in Oakland. "The old lights give off a yellow-green fuzzy color, while new lights are a warm, white glow." The new type of illumination is the result of a pilot program on the Richmond-San Rafael and Carquinez Bridges, both of which Caltrans owns and operates.

The LED lights are another Caltrans energy-saving project, saving as much as 60 percent more energy than the old high-pressure sodium "cobra lights". Unlike the cobra lights, the LEDs do not draw extra power when they are switched on. And they last up to 10 years — five times longer than high-pressure sodium bulbs. That not only cuts maintenance costs significantly, but reduces maintenance crews' exposure to potentially lethal traffic.





LED lights are illuminating the way to a cleaner, brighter future.

the San Francisco International Airport, and the Interstate 280/I-680/US-101 interchange in Santa Clara County.

In the long term, the LED lights could help solve a stubborn dilemma. Public safety requires streets, highways, and parking lots to be adequately illuminated at night. At the same time, the public and private sectors are under increasing pressure to reduce energy use. The LED lights will help ensure continued public safety and will do so with a substantially smaller carbon footprint. Now that Caltrans has field tested the new lights, proving their effectiveness, local governments and businesses are expected to follow.

Caltrans, for example, is experimenting with LED traffic signals, extinguishable LED message signs, and various solar-powered LED systems. At least one maintenance crew in the Los Angeles area has installed LED “smart studs,” raised pavement markers on the Santa Monica Freeway inside the McClure Tunnel near the Pacific Coast Highway to help drivers negotiate the roadway.

It should be clear that Caltrans is out in front, leading the way toward a brighter and greener future.

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